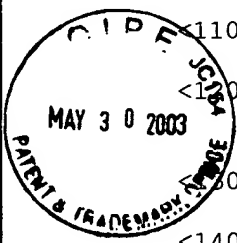


SEQUENCE LISTING

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<110> EIJISINK, VINCENT et al.
 <120> EXPRESSION SYSTEM IN MICROORGANISM AND ITS USE FOR EXPRESSING
 HETEROLOGOUS AND HOMOLOGOUS PROTEINS
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 <140> US 09/068,507
 <141> 1998-07-15
 <160> 19
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 Thr Val Asp Trp Gly Thr Ala Ile Gly Asn Ile Gly Asn Asn Ala Ala
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Tyr Arg Tyr Ile Gln Arg Lys Ile Thr Phe Lys Arg Ile Ile Leu Asp
25 30 35

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Gln Gln Lys Glu Asn Lys Ile Lys Thr Thr Asp Thr Ala Asn Leu Ile
75 80 85

Leu Ile Ile Val Ile Gln Leu Leu Leu Val Ala Val Gly Thr Ile Ile
90 95 100

Ser Gln Phe Thr Ile Ser Ile Ile Lys Ser Asp Phe Ser Gln Asn Ile
105 110 115

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Leu Asn Asn Ser Ala Thr Asp Ile Thr Leu Leu Gly Ile Phe Phe Ala	
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Val Leu Phe Asp Gly Leu Phe Phe Ile Leu Leu Lys Asn Lys Arg Thr	
140 145 150	
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Glu Leu Gln His Leu Asn Gln Glu Ile Ile Glu Phe Ser Leu Glu Lys	
155 160 165	
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Gln Tyr Phe Ile Phe Ile Phe Ile Leu Phe Ile Val Ile Glu Ile Ile	
170 175 180	
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Leu Ala Val Gly Asn Leu Gln Gly Val Thr Ala Thr Ile Leu Leu Thr	
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Ile Ile Ile Ile Phe Cys Val Leu Ile Gly Met Thr Phe Trp Gln Val	
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Ala Tyr Tyr Gln Glu Leu Leu Ala Gln Arg Pro Ile Gln Ser Glu Ile	
280 285 290 295	
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Gln Gly Ala Val Ile Ala Gln Leu Asp Tyr Leu Lys Asn Asp Pro Ile	
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Arg Gly Leu Val Ile Gln Lys Phe Leu Ala Ala Lys Gln Ala Gly Val	
315 320 325	
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Thr Leu Lys Phe Glu Met Thr Glu Pro Ile Glu Leu Ala Thr Ala Asn	
330 335 340	
cta tta acg gtt att cgg att atc ggt att tta tta gac aat gcg att	1648

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Glu	Gln	Ala	Val	Gln	Glu	Thr	Asp	Gln	Leu	Val	Ser	Cys	Ala	Phe	Leu		
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caa	tct	gat	ggt	tta	atc	gaa	att	acg	att	gaa	aat	acg	gcc	agt	caa	1744	
Gln	Ser	Asp	Gly	Leu	Ile	Glu	Ile	Thr	Ile	Glu	Asn	Thr	Ala	Ser	Gln		
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Gln	Thr	Asn	Leu	Phe	Leu	Glu	Thr	Gln	Ile	Glu	Asn	Arg	Lys	Leu	Arg		
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Ser	Asp	Thr	Glu	Thr	Leu	Leu	Ala	Ala	Ile	Lys	Asp	Gln	Gln	Arg	Gly		
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Leu	Phe	Phe	Leu	Asp	Met	Glu	Ile	Glu	Asp	Asn	Arg	Gln	Ala	Gly	Leu		
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gaa	gtg	gca	act	aag	att	cgg	cag	atg	atg	ccg	ttt	gcg	caa	att	gtc	2177	
Glu	Val	Ala	Thr	Lys	Ile	Arg	Gln	Met	Met	Pro	Phe	Ala	Gln	Ile	Val		
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Ile	Ala	Pro	Leu	Asp	Tyr	Ile	Leu	Lys	Asp	Gln	Thr	Met	Ala	Glu	Ile		
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cgc ttt ttc tca tta cca tta aag gaa gtt gtt tat tta tat act gaa Arg Phe Phe Ser Leu Pro Leu Lys Glu Val Val Tyr Leu Tyr Thr Glu 600 605 610			2417
aaa gaa aat ccg ggt cat att aat ttg tta gcc gtt acc aga aag gtt Lys Glu Asn Pro Gly His Ile Asn Leu Leu Ala Val Thr Arg Lys Val 615 620 625 630			2465
act ttt cca gga aat tta aat gcg ctg gaa gcc caa tat cca atg ctc Thr Phe Pro Gly Asn Leu Asn Ala Leu Glu Ala Gln Tyr Pro Met Leu 635 640 645			2513
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tgg gga aca gct att gga aat atc gga aat aat gca gct gca aac tgg Trp Gly Thr Ala Ile Gly Asn Ile Gly Asn Asn Ala Ala Ala Asn Trp 735 740 745			2965
gcc aca ggc gga aac gct ggc tgg aat aaa taa taagcaaaac ttaatttaga Ala Thr Gly Gly Asn Ala Gly Trp Asn Lys 750 755			3018
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cgc gga gaa cgg gca aat gat att ata ggc caa ttg ttg cta gat ctg	3175
Arg Gly Glu Arg Ala Asn Asp Ile Ile Gly Gln Leu Leu Leu Asp Leu	
770 775 780 785	
aac cat gat cca aaa aat gaa cat tta gaa gca ata tta ata aat tat	3223
Asn His Asp Pro Lys Asn Glu His Leu Glu Ala Ile Leu Ile Asn Tyr	
790 795 800	
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Gln Asn Glu Ile Lys Arg Lys Glu Ser Ser Val Pro Phe Ile Leu Ser	
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Leu Thr Asp Phe Gln Glu Asp Lys Leu Lys Leu Leu Thr Ala Leu Ser	
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Asn Ile Arg Tyr Gly Tyr	
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Met Ile Asp Arg Lys Ile Tyr Ile Pro Gln Val	
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Tyr Gly Ser Ser Ala Ser Leu Ala Tyr Leu Arg Asn Glu Ala Lys Thr	
885 890 895	
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Asp Leu Glu Gly Thr Thr Ala Leu Gly Leu Val Lys Thr Ala Glu Asn	
900 905 910	
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Leu Gly Phe Glu Thr Lys Ala Ile Gln Ala Asp Met Ser Leu Phe Glu	

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Val Ala Asp Leu Pro Phe Pro Phe Ile Ala His Val Leu Lys Asn Gly	935	940	945	
gag cta tta cat tat tat gtt gta cta ggg ata aaa aaa gat gcc att				4059
Glu Leu Leu His Tyr Tyr Val Val Leu Gly Ile Lys Lys Asp Ala Ile	950	955	960	
ata atc gcc gat cct gat cca aca gtg ggc atc gct aag atg acg caa				4107
Ile Ile Ala Asp Pro Asp Pro Thr Val Gly Ile Ala Lys Met Thr Gln	965	970	975	
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Ser Gln Phe Lys Ser Glu Trp Thr Gly Val Ala Leu Phe Ile Ala Pro	980	985	990	
aaa ccg agc tat caa cca gtt aag cag caa aca aaa gcg agt tta				4200
Lys Pro Ser Tyr Gln Pro Val Lys Gln Gln Thr Lys Ala Ser Leu	995	1000	1005	
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Phe Ser Phe Val Pro Thr Leu Met Gln Gln Lys Arg Leu Val Ile	1010	1015	1020	
aat att act ttg gcg gcg cta ctc ata acc att att agt att cta				4290
Asn Ile Thr Leu Ala Ala Leu Leu Ile Thr Ile Ile Ser Ile Leu	1025	1030	1035	
gga tct tat ttc tta cag act gtc att gat acc tat atc cca aat				4335
Gly Ser Tyr Phe Leu Gln Thr Val Ile Asp Thr Tyr Ile Pro Asn	1040	1045	1050	
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Asn Met Gln Ser Thr Leu Ala Ile Val Ala Ile Gly Leu Ile Ile	1055	1060	1065	
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Phe Tyr Gly Phe Gln Ser Ile Phe Thr Tyr Ala Gln Asn Phe Leu	1070	1075	1080	
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Leu Ala Val Leu Gly Gln Arg Leu Ser Ile Glu Ile Ile Leu Ser	1085	1090	1095	
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Tyr Leu Arg His Val Phe Glu Leu Pro Met Ser Phe Phe Ala Thr	1100	1105	1110	
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Arg Lys Thr Gly Glu Ile Ile Ser Arg Phe Asn Asp Ala Asn Lys	1115	1120	1125	
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Ile Ile Asp Ala Leu Ala Ser Ala Ile Ile Ser Ile Phe Leu Asp	1130	1135	1140	

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1145					1150					1155					
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Thr	Thr	Leu	Phe	Trp	Leu	Thr	Leu	Ala	Val	Ile	Pro	Ile	Tyr	Ile	
1160					1165					1170					
gcc	gtg	att	act	tta	ttt	gca	aaa	cct	ttt	gaa	aaa	tta	aat	caa	4740
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Lys	Glu	Met	Glu	Ser	Asn	Ala	Val	Leu	Asn	Ser	Ala	Ile	Ile	Glu	
1190					1195					1200					
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Asp	Leu	His	Gly	Ile	Glu	Thr	Ile	Lys	Ala	Leu	Thr	Ser	Glu	Ser	
1205					1210					1215					
gaa	cga	tat	caa	aaa	ata	gat	aca	gca	ttt	gtt	gat	tat	ctg	aag	4875
Glu	Arg	Tyr	Gln	Lys	Ile	Asp	Thr	Ala	Phe	Val	Asp	Tyr	Leu	Lys	
1220					1225					1230					
aag	agt	ttt	gac	tat	gta	aaa	gct	gat	aca	ttg	caa	caa	gca	att	4920
Lys	Ser	Phe	Asp	Tyr	Val	Lys	Ala	Asp	Thr	Leu	Gln	Gln	Ala	Ile	
1235					1240					1245					
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Lys	Leu	Phe	Val	Gln	Leu	Gly	Leu	Asn	Val	Phe	Val	Leu	Trp	Val	
1250					1255					1260					
ggc	gct	att	tta	gtc	acg	cat	aac	gag	tta	tca	att	ggg	caa	ttg	5010
Gly	Ala	Ile	Leu	Val	Thr	His	Asn	Glu	Leu	Ser	Ile	Gly	Gln	Leu	
1265					1270					1275					
atg	acc	tac	aat	gcc	ttg	ctg	gcg	tat	ttt	gta	aat	ccg	tta	cag	5055
Met	Thr	Tyr	Asn	Ala	Leu	Leu	Ala	Tyr	Phe	Val	Asn	Pro	Leu	Gln	
1280					1285					1290					
aat	atc	atc	aat	tta	cag	act	aag	tta	cag	agc	gcg	agg	gta	gcc	5100
Asn	Ile	Ile	Asn	Leu	Gln	Thr	Lys	Leu	Gln	Ser	Ala	Arg	Val	Ala	
1295					1300					1305					
aat	aat	cgg	ttg	aat	gaa	gtt	tat	ctg	gtt	gat	tct	gag	ttc	aag	5145
Asn	Asn	Arg	Leu	Asn	Glu	Val	Tyr	Leu	Val	Asp	Ser	Glu	Phe	Lys	
1310					1315					1320					
aca	gaa	cga	cca	att	aaa	tcc	gag	tca	cag	ttg	gta	ggc	cca	att	5190
Thr	Glu	Arg	Pro	Ile	Lys	Ser	Glu	Ser	Gln	Leu	Val	Gly	Pro	Ile	
1325					1330					1335					
gag	tta	caa	aat	gtg	agt	tac	caa	tat	ggg	tat	ggg	cag	aga	gtg	5235
Glu	Leu	Gln	Asn	Val	Ser	Tyr	Gln	Tyr	Gly	Tyr	Gly	Gln	Arg	Val	
1340					1345					1350					

ctt	gaa	tcg	att	agt	tta	aag	att	gag	ccg	aat	gaa	aaa	tta	aca	5280
Leu	Glu	Ser	Ile	Ser	Leu	Lys	Ile	Glu	Pro	Asn	Glu	Lys	Leu	Thr	
1355					1360					1365					
att	gtg	ggc	atg	agc	ggg	tcg	ggg	aaa	tca	aca	ttg	gtt	aag	tta	5325
Ile	Val	Gly	Met	Ser	Gly	Ser	Gly	Lys	Ser	Thr	Leu	Val	Lys	Leu	
1370					1375					1380					
ctc	gtt	aat	ttt	ttt	gaa	cca	acg	gag	gga	aag	gtt	ctt	ttt	aat	5370
Leu	Val	Asn	Phe	Phe	Glu	Pro	Thr	Glu	Gly	Lys	Val	Leu	Phe	Asn	
1385					1390					1395					
caa	caa	gat	aca	cag	aca	att	gat	aaa	aag	aca	ttg	cgg	cag	ttt	5415
Gln	Gln	Asp	Thr	Gln	Thr	Ile	Asp	Lys	Lys	Thr	Leu	Arg	Gln	Phe	
1400					1405					1410					
gtt	aac	tat	att	gca	cag	aca	ccg	tac	att	ttc	tca	gga	agt	att	5460
Val	Asn	Tyr	Ile	Ala	Gln	Thr	Pro	Tyr	Ile	Phe	Ser	Gly	Ser	Ile	
1415					1420					1425					
tgg	gat	aat	ctt	aag	tta	ggg	aat	cgg	cca	gga	atc	aca	caa	gcg	5505
Trp	Asp	Asn	Leu	Lys	Leu	Gly	Asn	Arg	Pro	Gly	Ile	Thr	Gln	Ala	
1430					1435					1440					
gac	atc	atg	cat	gcg	tgt	gag	cta	gca	gag	ata	aag	aat	gat	att	5550
Asp	Ile	Met	His	Ala	Cys	Glu	Leu	Ala	Glu	Ile	Lys	Asn	Asp	Ile	
1445					1450					1455					
gaa	aaa	atg	ccg	ctc	caa	ttt	gaa	aca	tta	ttg	gat	gaa	gat	gga	5595
Glu	Lys	Met	Pro	Leu	Gln	Phe	Glu	Thr	Leu	Leu	Asp	Glu	Asp	Gly	
1460					1465					1470					
aac	aca	ttg	tca	ggg	ggg	caa	aaa	cag	cga	tta	aca	att	gcg	cga	5640
Asn	Thr	Leu	Ser	Gly	Gly	Gln	Lys	Gln	Arg	Leu	Thr	Ile	Ala	Arg	
1475					1480					1485					
gca	cta	tta	tca	cca	gct	cgg	gta	cta	att	ttt	gat	gag	tct	act	5685
Ala	Leu	Leu	Ser	Pro	Ala	Arg	Val	Leu	Ile	Phe	Asp	Glu	Ser	Thr	
1490					1495					1500					
agt	ggg	tta	gat	acg	ata	aca	gag	ggg	cta	tta	gtt	gat	cat	cta	5730
Ser	Gly	Leu	Asp	Thr	Ile	Thr	Glu	Gly	Leu	Leu	Val	Asp	His	Leu	
1505					1510					1515					
atg	gcg	tta	gaa	gaa	aga	aca	atc	att	ttc	ata	gcg	cat	cgt	tta	5775
Met	Ala	Leu	Glu	Glu	Arg	Thr	Ile	Ile	Phe	Ile	Ala	His	Arg	Leu	
1520					1525					1530					
gcg	att	gct	aag	aaa	acg	aac	aat	att	ctt	gtt	tta	gaa	aat	ggg	5820
Ala	Ile	Ala	Lys	Lys	Thr	Asn	Asn	Ile	Leu	Val	Leu	Glu	Asn	Gly	
1535					1540					1545					
agt	gtt	gtt	gaa	act	ggg	aca	cat	gat	gcg	ttg	gtg	gat	aca	caa	5865
Ser	Val	Val	Glu	Thr	Gly	Thr	His	Asp	Ala	Leu	Val	Asp	Thr	Gln	
1550					1555					1560					
ggg	cga	tat	tac	caa	ttg	ctc	aat	cat	tag	tgggggg	atta	aagt	atg		5912

Gly	Arg	Tyr	Tyr	Gln	Leu	Leu	Asn	His						Met	
1565					1570										
gat	aaa	gag	ttt	ctg	gag	agc	agt	gag	ttt	tat	agt	gcg	cgg	ttt	5957
Asp	Lys	Glu	Phe	Leu	Glu	Ser	Ser	Glu	Phe	Tyr	Ser	Ala	Arg	Phe	
1575					1580					1585					
aaa	aat	ttt	tca	aca	cta	tta	att	atg	cca	att	gca	gtt	cta	ctt	6002
Lys	Asn	Phe	Ser	Thr	Leu	Leu	Ile	Met	Pro	Ile	Ala	Val	Leu	Leu	
1590					1595					1600					
tgt	ctc	gta	tgc	atc	ttt	tct	ttt	ttt	ggg	aaa	cga	gaa	att	acg	6047
Cys	Leu	Val	Cys	Ile	Phe	Ser	Phe	Phe	Gly	Lys	Arg	Glu	Ile	Thr	
1605					1610					1615					
att	gaa	ggg	caa	ggg	gat	tta	acg	acg	aat	aaa	cag	att	cca	ata	6092
Ile	Glu	Gly	Gln	Gly	Asp	Leu	Thr	Thr	Asn	Lys	Gln	Ile	Pro	Ile	
1620					1625					1630					
tta	caa	gcc	tct	act	aat	agt	gta	tta	aag	caa	aat	tat	tta	aaa	6137
Leu	Gln	Ala	Ser	Thr	Asn	Ser	Val	Leu	Lys	Gln	Asn	Tyr	Leu	Lys	
1635					1640					1645					
gaa	gga	aag	ttt	gtc	aag	aaa	ggg	cag	act	ttg	ctt	gtg	tat	caa	6182
Glu	Gly	Lys	Phe	Val	Lys	Lys	Gly	Gln	Thr	Leu	Leu	Val	Tyr	Gln	
1650					1655					1660					
aat	act	aaa	aat	cag	aat	cag	aaa	cgg	cta	tta	gaa	aaa	caa	cag	6227
Asn	Thr	Lys	Asn	Gln	Asn	Gln	Lys	Arg	Leu	Leu	Glu	Lys	Gln	Gln	
1665					1670					1675					
gat	aat	ctg	agt	tat	cag	att	acg	agt	ttg	gaa	aca	ttg	aaa	gct	6272
Asp	Asn	Leu	Ser	Tyr	Gln	Ile	Thr	Ser	Leu	Glu	Thr	Leu	Lys	Ala	
1680					1685					1690					
agc	att	cgc	agt	aat	caa	gac	caa	ttt	gag	aat	aat	gat	cag	ttt	6317
Ser	Ile	Arg	Ser	Asn	Gln	Asp	Gln	Phe	Glu	Asn	Asn	Asp	Gln	Phe	
1695					1700					1705					
ggg	tac	aga	gat	tta	tta	cga	ggg	tat	ctt	gac	caa	aga	caa	gtt	6362
Gly	Tyr	Arg	Asp	Leu	Leu	Arg	Gly	Tyr	Leu	Asp	Gln	Arg	Gln	Val	
1710					1715					1720					
tat	ttg	att	gaa	aat	cag	atg	gtg	aca	gat	aaa	gca	gcg	aca	agt	6407
Tyr	Leu	Ile	Glu	Asn	Gln	Met	Val	Thr	Asp	Lys	Ala	Ala	Thr	Ser	
1725					1730					1735					
aca	act	aaa	caa	cag	aca	ttg	aca	gcg	att	atg	gat	aag	aca	att	6452
Thr	Thr	Lys	Gln	Gln	Thr	Leu	Thr	Ala	Ile	Met	Asp	Lys	Thr	Ile	
1740					1745					1750					
caa	cga	gat	caa	aca	aat	ctt	gac	gcg	tat	caa	gct	tta	tat	cag	6497
Gln	Arg	Asp	Gln	Thr	Asn	Leu	Asp	Ala	Tyr	Gln	Ala	Leu	Tyr	Gln	
1755					1760					1765					
tca	atc	aaa	act	aac	aag	gta	tat	tca	agt	act	ggg	aaa	tat	aat	6542
Ser	Ile	Lys	Thr	Asn	Lys	Val	Tyr	Ser	Ser	Thr	Gly	Lys	Tyr	Asn	

1770	1775	1780	
tat ctt tac gag aac tat	caa acg aaa gta aaa	gcg atg tct gat	6587
Tyr Leu Tyr Glu Asn Tyr	Gln Thr Lys Val Lys	Ala Met Ser Asp	
1785	1790	1795	
aaa aat gaa caa agt ggt	tta aaa gca gat att	tta gca acg acg	6632
Lys Asn Glu Gln Ser Gly	Leu Lys Ala Asp Ile	Leu Ala Thr Thr	
1800	1805	1810	
caa caa caa att gat agt	tta caa ggt agt ata	gcg aat gcc gaa	6677
Gln Gln Gln Ile Asp Ser	Leu Gln Gly Ser Ile	Ala Asn Ala Glu	
1815	1820	1825	
aat caa aaa gtt tcc ata	aaa gaa ttt gac gat	agc cgg ttt aat	6722
Asn Gln Lys Val Ser Ile	Lys Glu Phe Asp Asp	Ser Arg Phe Asn	
1830	1835	1840	
acg aat act aat aat gaa	aag tta gca tta tta	gaa gca cag caa	6767
Thr Asn Thr Asn Asn Glu	Lys Leu Ala Leu Leu	Glu Ala Gln Gln	
1845	1850	1855	
aca caa tca gca aat gaa	cag ctt gta aaa gct	aaa caa tca ctt	6812
Thr Gln Ser Ala Asn Glu	Gln Leu Val Lys Ala	Lys Gln Ser Leu	
1860	1865	1870	
gtc gaa ata caa aca act	tta aaa caa ata acg	agt gat tct aag	6857
Val Glu Ile Gln Thr Thr	Leu Lys Gln Ile Thr	Ser Asp Ser Lys	
1875	1880	1885	
gaa tac gtg gtt aaa gca	cct aaa gac gga gtt	cta cat gtt gat	6902
Glu Tyr Val Val Lys Ala	Pro Lys Asp Gly Val	Leu His Val Asp	
1890	1895	1900	
gat cac tat caa ggg att	aag tat acg agt gct	ggg acc agt atg	6947
Asp His Tyr Gln Gly Ile	Lys Tyr Thr Ser Ala	Gly Thr Ser Met	
1905	1910	1915	
gcg cgg att tat ccg gta	tta gct gat cag aag	aga tta aaa ata	6992
Ala Arg Ile Tyr Pro Val	Leu Ala Asp Gln Lys	Arg Leu Lys Ile	
1920	1925	1930	
gaa gcg ctt att cca gtt	gat gat att tca tca	gtt aaa att gga	7037
Glu Ala Leu Ile Pro Val	Asp Asp Ile Ser Ser	Val Lys Ile Gly	
1935	1940	1945	
caa aga cta cgt ttg aaa	att acg cgg aat gtt	cca aga cca att	7082
Gln Arg Leu Arg Leu Lys	Ile Thr Arg Asn Val	Pro Arg Pro Ile	
1950	1955	1960	
att att gaa gga aag atc	aat caa att agt gtt	tcg cct act gtt	7127
Ile Ile Glu Gly Lys Ile	Asn Gln Ile Ser Val	Ser Pro Thr Val	
1965	1970	1975	
att aac cag ggg agt tac	tac act att ata ggt	ctg gca act att	7172
Ile Asn Gln Gly Ser Tyr	Tyr Thr Ile Ile Gly	Leu Ala Thr Ile	
1980	1985	1990	

tct	aat	aat	aat	agg	aaa	tta	ctg	cat	tat	gga	atg	acc	ggt	aaa	7217
Ser	Asn	Asn	Asn	Arg	Lys	Leu	Leu	His	Tyr	Gly	Met	Thr	Gly	Lys	
1995					2000					2005					

ata	gca	att	atc	act	ggt	aag	aca	aca	ttc	ttc	aac	tat	tac	aaa	7262
Ile	Ala	Ile	Ile	Thr	Gly	Lys	Thr	Thr	Phe	Phe	Asn	Tyr	Tyr	Lys	
2010					2015					2020					

gat	aag	ttg	ttg	aat	aga	aat	tag	gtgggtatta	ccatataaat	7306
Asp	Lys	Leu	Leu	Asn	Arg	Asn				
2025					2030					

tatgagagtt	tccttggttt	aaaattaatt	tgaaaattga	tattagcggt	taacagttaa	7366
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attaatacgt	taataatttt	tttgtcttta	aatagggatt	tgaagcataa	tggtgttata	7426
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gcgtacttag	ctggccagca	tatatgtatt	ctataaaata	ctattacaag	gagattttag	7486
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atatgcaaaa	tacaaaagaa	ctaagcgtag	tagaattaca	acaaattctt	ggaggaaaac	7546
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gtgctagctt	tggtaaatgt	gtagttggtg	cttgggggagc	tggtgcagct	g	7597
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 <213> Lactobacillus sakei

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Met	Leu	Tyr	Thr	Asp	Val	Ser	Val	Ser	Leu	Met	Gln	Asn	Phe	Val	Ala
1				5					10					15	

Ile	Leu	Leu	Ile	Phe	Leu	Leu	Tyr	Arg	Tyr	Ile	Gln	Arg	Lys	Ile	Thr
		20						25					30		

Phe	Lys	Arg	Ile	Ile	Leu	Asp	Ile	Leu	Ile	Ala	Ile	Ile	Phe	Ser	Ile
		35					40					45			

Leu	Tyr	Leu	Phe	Ile	Ser	Asp	Ala	Ser	Leu	Leu	Val	Met	Val	Leu	Met
	50					55					60				

Arg	Leu	Gly	Trp	His	Phe	His	Gln	Gln	Lys	Glu	Asn	Lys	Ile	Lys	Thr
65					70					75					80

Thr	Asp	Thr	Ala	Asn	Leu	Ile	Leu	Ile	Ile	Val	Ile	Gln	Leu	Leu	Leu
				85					90					95	

Val	Ala	Val	Gly	Thr	Ile	Ile	Ser	Gln	Phe	Thr	Ile	Ser	Ile	Ile	Lys
			100					105					110		

Ser Asp Phe Ser Gln Asn Ile Leu Asn Asn Ser Ala Thr Asp Ile Thr
115 120 125

Leu Leu Gly Ile Phe Phe Ala Val Leu Phe Asp Gly Leu Phe Phe Ile
130 135 140

Leu Leu Lys Asn Lys Arg Thr Glu Leu Gln His Leu Asn Gln Glu Ile
145 150 155 160

Ile Glu Phe Ser Leu Glu Lys Gln Tyr Phe Ile Phe Ile Phe Ile Leu
165 170 175

Phe Ile Val Ile Glu Ile Ile Leu Ala Val Gly Asn Leu Gln Gly Val
180 185 190

Thr Ala Thr Ile Leu Leu Thr Ile Ile Ile Ile Phe Cys Val Leu Ile
195 200 205

Gly Met Thr Phe Trp Gln Val Met Leu Phe Leu Lys Ala Tyr Ser Ile
210 215 220

Arg Gln Glu Ala Asn Asp Gln Leu Val Arg Asn Gln Gln Leu Gln Asp
225 230 235 240

Tyr Leu Val Asn Ile Glu Gln Gln Tyr Thr Glu Leu Arg Arg Phe Lys
245 250 255

His Asp Tyr Gln Asn Ile Leu Leu Ser Leu Glu Ser Phe Ala Glu Lys
260 265 270

Gly Asp Gln Gln Gln Phe Lys Ala Tyr Tyr Gln Glu Leu Leu Ala Gln
275 280 285

Arg Pro Ile Gln Ser Glu Ile Gln Gly Ala Val Ile Ala Gln Leu Asp
290 295 300

Tyr Leu Lys Asn Asp Pro Ile Arg Gly Leu Val Ile Gln Lys Phe Leu
305 310 315 320

Ala Ala Lys Gln Ala Gly Val Thr Leu Lys Phe Glu Met Thr Glu Pro
325 330 335

Ile Glu Leu Ala Thr Ala Asn Leu Leu Thr Val Ile Arg Ile Ile Gly
340 345 350

Ile Leu Leu Asp Asn Ala Ile Glu Gln Ala Val Gln Glu Thr Asp Gln
355 360 365

Leu Val Ser Cys Ala Phe Leu Gln Ser Asp Gly Leu Ile Glu Ile Thr
370 375 380

Ile Glu Asn Thr Ala Ser Gln Val Lys Asn Leu Gln Ala Phe Ser Glu
385 390 395 400

Leu Gly Tyr Ser Thr Lys Gly Ala Gly Arg Gly Thr Gly Leu Ala Asn
405 410 415

Val Gln Asp Leu Ile Ala Lys Gln Thr Asn Leu Phe Leu Glu Thr Gln
420 425 430

Ile Glu Asn Arg Lys Leu Arg Gln Thr Leu Met Ile Thr Glu Glu Thr
435 440 445

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<213> Lactobacillus sakei

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Leu Tyr Pro Val Tyr Leu Leu Glu Asp Asp Leu Gln Gln Gln Ala Ile
1 5 10 15

Tyr Gln Gln Ile Ile Ala Asn Thr Ile Met Ile Asn Glu Phe Ala Met
20 25 30

Thr Leu Thr Cys Ala Ala Ser Asp Thr Glu Thr Leu Leu Ala Ala Ile
35 40 45

Lys Asp Gln Gln Arg Gly Leu Phe Phe Leu Asp Met Glu Ile Glu Asp
50 55 60

Asn Arg Gln Ala Gly Leu Glu Val Ala Thr Lys Ile Arg Gln Met Met
65 70 75 80

Pro Phe Ala Gln Ile Val Phe Ile Thr Thr His Glu Glu Leu Thr Leu

85

90

95

Leu Thr Leu Glu Arg Lys Ile Ala Pro Leu Asp Tyr Ile Leu Lys Asp
 100 105 110

Gln Thr Met Ala Glu Ile Lys Arg Gln Leu Ile Asp Asp Leu Leu Leu
 115 120 125

Ala Glu Lys Gln Asn Glu Ala Ala Ala Tyr His Arg Glu Asn Leu Phe
 130 135 140

Ser Tyr Lys Ile Gly Pro Arg Phe Phe Ser Leu Pro Leu Lys Glu Val
 145 150 155 160

Val Tyr Leu Tyr Thr Glu Lys Glu Asn Pro Gly His Ile Asn Leu Leu
 165 170 175

Ala Val Thr Arg Lys Val Thr Phe Pro Gly Asn Leu Asn Ala Leu Glu
 180 185 190

Ala Gln Tyr Pro Met Leu Phe Arg Cys Asp Lys Ser Tyr Leu Val Asn
 195 200 205

Leu Ser Asn Ile Ala Asn Tyr Asp Ser Lys Thr Arg Ser Leu Lys Phe
 210 215 220

Val Asp Gly Ser Glu Ala Lys Val Ser Phe Arg Lys Ser Arg Glu Leu
 225 230 235 240

Val Ala Lys Leu Lys Gln Met Met
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<400> 16

Met Glu Lys Phe Ile Glu Leu Ser Leu Lys Glu Val Thr Ala Ile Thr
 1 5 10 15

Gly Gly Lys Tyr Tyr Gly Asn Gly Val His Cys Gly Lys His Ser Cys
 20 25 30

Thr Val Asp Trp Gly Thr Ala Ile Gly Asn Ile Gly Asn Asn Ala Ala
 35 40 45

Ala Asn Trp Ala Thr Gly Gly Asn Ala Gly Trp Asn Lys
 50 55 60

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Met Lys Ile Leu Lys Trp Tyr Ser Gly Gly Lys Asp Arg Gly Glu Arg
 1 5 10 15

Ala Asn Asp Ile Ile Gly Gln Leu Leu Leu Asp Leu Asn His Asp Pro
 20 25 30

Lys Asn Glu His Leu Glu Ala Ile Leu Ile Asn Tyr Gln Asn Glu Ile
 35 40 45

Lys Arg Lys Glu Ser Ser Val Pro Phe Ile Leu Ser Arg Met Asn Ile
 50 55 60

Ser Ile Ala Asn Thr Ile Arg Arg Asp Arg Leu Ile Leu Thr Asp Phe
 65 70 75 80

Gln Glu Asp Lys Leu Lys Leu Leu Thr Ala Leu Ser Asn Ile Arg Tyr
 85 90 95

Gly Tyr

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Met Ile Asp Arg Lys Ile Tyr Ile Pro Gln Val Asp Glu Met Asp Cys
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Gly Val Ala Ala Leu Ala Met Ile Leu Lys His Tyr Gly Ser Ser Ala
 20 25 30

Ser Leu Ala Tyr Leu Arg Asn Glu Ala Lys Thr Asp Leu Glu Gly Thr
35 40 45

Thr Ala Leu Gly Leu Val Lys Thr Ala Glu Asn Leu Gly Phe Glu Thr
50 55 60

Lys Ala Ile Gln Ala Asp Met Ser Leu Phe Glu Val Ala Asp Leu Pro
65 70 75 80

Phe Pro Phe Ile Ala His Val Leu Lys Asn Gly Glu Leu Leu His Tyr
85 90 95

Tyr Val Val Leu Gly Ile Lys Lys Asp Ala Ile Ile Ile Ala Asp Pro
100 105 110

Asp Pro Thr Val Gly Ile Ala Lys Met Thr Gln Ser Gln Phe Lys Ser
115 120 125

Glu Trp Thr Gly Val Ala Leu Phe Ile Ala Pro Lys Pro Ser Tyr Gln
130 135 140

Pro Val Lys Gln Gln Thr Lys Ala Ser Leu Phe Ser Phe Val Pro Thr
145 150 155 160

Leu Met Gln Gln Lys Arg Leu Val Ile Asn Ile Thr Leu Ala Ala Leu
165 170 175

Leu Ile Thr Ile Ile Ser Ile Leu Gly Ser Tyr Phe Leu Gln Thr Val
180 185 190

Ile Asp Thr Tyr Ile Pro Asn Asn Met Gln Ser Thr Leu Ala Ile Val
195 200 205

Ala Ile Gly Leu Ile Ile Phe Tyr Gly Phe Gln Ser Ile Phe Thr Tyr
210 215 220

Ala Gln Asn Phe Leu Leu Ala Val Leu Gly Gln Arg Leu Ser Ile Glu
225 230 235 240

Ile Ile Leu Ser Tyr Leu Arg His Val Phe Glu Leu Pro Met Ser Phe
245 250 255

Phe Ala Thr Arg Lys Thr Gly Glu Ile Ile Ser Arg Phe Asn Asp Ala
 260 265 270

Asn Lys Ile Ile Asp Ala Leu Ala Ser Ala Ile Ile Ser Ile Phe Leu
 275 280 285

Asp Ile Thr Val Val Val Ile Met Gly Ile Ile Leu Ile Ile Gln Asn
 290 295 300

Thr Thr Leu Phe Trp Leu Thr Leu Ala Val Ile Pro Ile Tyr Ile Ala
 305 310 315 320

Val Ile Thr Leu Phe Ala Lys Pro Phe Glu Lys Leu Asn Gln Lys Glu
 325 330 335

Met Glu Ser Asn Ala Val Leu Asn Ser Ala Ile Ile Glu Asp Leu His
 340 345 350

Gly Ile Glu Thr Ile Lys Ala Leu Thr Ser Glu Ser Glu Arg Tyr Gln
 355 360 365

Lys Ile Asp Thr Ala Phe Val Asp Tyr Leu Lys Lys Ser Phe Asp Tyr
 370 375 380

Val Lys Ala Asp Thr Leu Gln Gln Ala Ile Lys Leu Phe Val Gln Leu
 385 390 395 400

Gly Leu Asn Val Phe Val Leu Trp Val Gly Ala Ile Leu Val Thr His
 405 410 415

Asn Glu Leu Ser Ile Gly Gln Leu Met Thr Tyr Asn Ala Leu Leu Ala
 420 425 430

Tyr Phe Val Asn Pro Leu Gln Asn Ile Ile Asn Leu Gln Thr Lys Leu
 435 440 445

Gln Ser Ala Arg Val Ala Asn Asn Arg Leu Asn Glu Val Tyr Leu Val
 450 455 460

Asp Ser Glu Phe Lys Thr Glu Arg Pro Ile Lys Ser Glu Ser Gln Leu
 465 470 475 480

Val Gly Pro Ile Glu Leu Gln Asn Val Ser Tyr Gln Tyr Gly Tyr Gly
 485 490 495

Gln Arg Val Leu Glu Ser Ile Ser Leu Lys Ile Glu Pro Asn Glu Lys
 500 505 510

Leu Thr Ile Val Gly Met Ser Gly Ser Gly Lys Ser Thr Leu Val Lys
 515 520 525

Leu Leu Val Asn Phe Phe Glu Pro Thr Glu Gly Lys Val Leu Phe Asn
 530 535 540

Gln Gln Asp Thr Gln Thr Ile Asp Lys Lys Thr Leu Arg Gln Phe Val
 545 550 555 560

Asn Tyr Ile Ala Gln Thr Pro Tyr Ile Phe Ser Gly Ser Ile Trp Asp
 565 570 575

Asn Leu Lys Leu Gly Asn Arg Pro Gly Ile Thr Gln Ala Asp Ile Met
 580 585 590

His Ala Cys Glu Leu Ala Glu Ile Lys Asn Asp Ile Glu Lys Met Pro
 595 600 605

Leu Gln Phe Glu Thr Leu Leu Asp Glu Asp Gly Asn Thr Leu Ser Gly
 610 615 620

Gly Gln Lys Gln Arg Leu Thr Ile Ala Arg Ala Leu Leu Ser Pro Ala
 625 630 635 640

Arg Val Leu Ile Phe Asp Glu Ser Thr Ser Gly Leu Asp Thr Ile Thr
 645 650 655

Glu Gly Leu Leu Val Asp His Leu Met Ala Leu Glu Glu Arg Thr Ile
 660 665 670

Ile Phe Ile Ala His Arg Leu Ala Ile Ala Lys Lys Thr Asn Asn Ile
 675 680 685

Leu Val Leu Glu Asn Gly Ser Val Val Glu Thr Gly Thr His Asp Ala
 690 695 700

Leu Val Asp Thr Gln Gly Arg Tyr Tyr Gln Leu Leu Asn His

705

710

715

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 <211> 458
 <212> PRT
 <213> Lactobacillus sakei

<400> 19

Met Asp Lys Glu Phe Leu Glu Ser Ser Glu Phe Tyr Ser Ala Arg Phe
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Lys Asn Phe Ser Thr Leu Leu Ile Met Pro Ile Ala Val Leu Leu Cys
 20 25 30

Leu Val Cys Ile Phe Ser Phe Phe Gly Lys Arg Glu Ile Thr Ile Glu
 35 40 45

Gly Gln Gly Asp Leu Thr Thr Asn Lys Gln Ile Pro Ile Leu Gln Ala
 50 55 60

Ser Thr Asn Ser Val Leu Lys Gln Asn Tyr Leu Lys Glu Gly Lys Phe
 65 70 75 80

Val Lys Lys Gly Gln Thr Leu Leu Val Tyr Gln Asn Thr Lys Asn Gln
 85 90 95

Asn Gln Lys Arg Leu Leu Glu Lys Gln Gln Asp Asn Leu Ser Tyr Gln
 100 105 110

Ile Thr Ser Leu Glu Thr Leu Lys Ala Ser Ile Arg Ser Asn Gln Asp
 115 120 125

Gln Phe Glu Asn Asn Asp Gln Phe Gly Tyr Arg Asp Leu Leu Arg Gly
 130 135 140

Tyr Leu Asp Gln Arg Gln Val Tyr Leu Ile Glu Asn Gln Met Val Thr
 145 150 155 160

Asp Lys Ala Ala Thr Ser Thr Thr Lys Gln Gln Thr Leu Thr Ala Ile
 165 170 175

Met Asp Lys Thr Ile Gln Arg Asp Gln Thr Asn Leu Asp Ala Tyr Gln
 180 185 190

Ala Leu Tyr Gln Ser Ile Lys Thr Asn Lys Val Tyr Ser Ser Thr Gly
 195 200 205

Lys Tyr Asn Tyr Leu Tyr Glu Asn Tyr Gln Thr Lys Val Lys Ala Met
 210 215 220

Ser Asp Lys Asn Glu Gln Ser Gly Leu Lys Ala Asp Ile Leu Ala Thr
 225 230 235 240

Thr Gln Gln Gln Ile Asp Ser Leu Gln Gly Ser Ile Ala Asn Ala Glu
 245 250 255

Asn Gln Lys Val Ser Ile Lys Glu Phe Asp Asp Ser Arg Phe Asn Thr
 260 265 270

Asn Thr Asn Asn Glu Lys Leu Ala Leu Leu Glu Ala Gln Gln Thr Gln
 275 280 285

Ser Ala Asn Glu Gln Leu Val Lys Ala Lys Gln Ser Leu Val Glu Ile
 290 295 300

Gln Thr Thr Leu Lys Gln Ile Thr Ser Asp Ser Lys Glu Tyr Val Val
 305 310 315 320

Lys Ala Pro Lys Asp Gly Val Leu His Val Asp Asp His Tyr Gln Gly
 325 330 335

Ile Lys Tyr Thr Ser Ala Gly Thr Ser Met Ala Arg Ile Tyr Pro Val
 340 345 350

Leu Ala Asp Gln Lys Arg Leu Lys Ile Glu Ala Leu Ile Pro Val Asp
 355 360 365

Asp Ile Ser Ser Val Lys Ile Gly Gln Arg Leu Arg Leu Lys Ile Thr
 370 375 380

Arg Asn Val Pro Arg Pro Ile Ile Ile Glu Gly Lys Ile Asn Gln Ile
 385 390 395 400

Ser Val Ser Pro Thr Val Ile Asn Gln Gly Ser Tyr Tyr Thr Ile Ile
 405 410 415

Gly Leu Ala Thr Ile Ser Asn Asn Asn Arg Lys Leu Leu His Tyr Gly
420 425 430

Met Thr Gly Lys Ile Ala Ile Ile Thr Gly Lys Thr Thr Phe Phe Asn
435 440 445

Tyr Tyr Lys Asp Lys Leu Leu Asn Arg Asn
450 455